

# Advice on Writing Proposals to the National Science Foundation

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The original version of this advice was written in the late 1980s. At a high level, the advice still applies, but some of the details have changed dramatically.

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What follows is a collection of advice for writing research grants to the National Science Foundation. It includes some guidelines on how to write an NSF proposal and how to get the latest version of the NSF forms. Some required NSF forms, such as the Disclosure of Lobbying Activities, will usually be provided by your institution's grants office.

This document focuses on writing proposals to NSF, but the general advice can be applied to writing any proposal.

## **I. General advice**

Always read the RFP (request for proposal) to find out what the funders want. They will give you money only if you can help them reach their goals. The goals of funding agencies (public and private) vary dramatically. A successful proposal to NSF looks nothing like a successful proposal to NASA. Even within an agency, the style of proposals can be different among internal divisions. Find out about the agency, its goals, and its review system.

All proposals should answer the following questions in one form or another.

- What is the problem being addressed? (What is the goal of the research being proposed? What is the hypothesis being tested?)
- Why is the problem important and interesting? To the world? To the funders?
- What will you DO to address the problem? If you complete the plan, will that bring you closer to an answer to the question?
- Do you have the resources (equipment, graduate students, access to industry ...) necessary to complete the research?

## **II. Writing NSF proposals**

NSF is organized a lot like a university, except that instead of departments and colleges it has divisions and directorates. The Program Directors (PDs, also equivalently called program managers and program officers) are like professors (and a lot of them are professors on leaves of absence). They have areas of specialization which correspond to the research areas covered by their programs. The division directors are like department chairs. They oversee the broad research areas covered by the programs and deal with administrative issues. The Assistant Directors are like Deans of Colleges. They lead the directorates and are responsible for the major research directions in Engineering, Physical Sciences, etc. The Director of NSF, who is like a university president or chancellor, is responsible for the overall direction of Science and Engineering Research. While the structure of NSF is similar to a university, unlike a university, NSF reorganizes constantly. This means that you may get to know a program director who may suddenly return to his or her university or may be reassigned to another program -- or that your program may be merged with a different program. While this is disconcerting in the short run, in the long run it keeps programs from stagnating and helps NSF keep on the forefront of research areas.

Find out which program supports your research area. (It's not always obvious). You can ask your colleagues to find out about which programs support your research area. Find out if there are other people at NSF you should talk to and what special initiatives might apply to you. You can find the list of telephone numbers and e-mail addresses from the NSF web site (<http://www.nsf.gov/>).

Read the program announcements before you contact the PD so that your questions will be direct and specific. The easiest way to get started is to send a brief email to the program director stating which program you are interested in applying to, a short statement of your relevant research interests, your availability by phone or email, and a one-page attachment

that covers the first three questions above: what's the problem, why it's important, and what your key idea is. Don't spend a lot of time/space giving the big picture on, e.g. cybersecurity; you are talking to an expert your area.

Some PDs prefer e-mail; some prefer phone calls. Some like to talk to Principal Investigators (PIs); some don't. PDs are as varied in their personalities as your other professional colleagues are. If you do talk to a PD on the phone, remember to listen; don't just pitch your idea non-stop. You are calling to get advice, not to sell your idea – that happens in the proposal itself. Remember to say "thank you." (Don't be discouraged if they are rough on you. They spend most of the day on the computer and the phone and the rest of the time they're traveling and staying in government-rate hotels.) Treat the PDs as if they are intelligent people (even if you doubt it). The PD will assign the reviewers and will make the final decision. You don't have to be a sycophant, just be polite. (This advice comes from a former NSF program director.)

Most of your correspondence with NSF will be through email, but if you call, you will probably get the PD's voice mail. Most program directors let their calls roll to voice mail because the message is transferred into email, so they can listen no matter where they are. Also, if you are calling about a proposal or a grant, include the NSF proposal number so the PD has all the information at hand when returning your call. When you call,

- clearly state who you are,
- your institutional affiliation,
- why you are calling,
- give the proposal or grant number if you have it, and
- provide several times when you will be available for a call back.

Also, oddly, the NSF phone system displays the caller ID when the call is in progress, but the number disappears after the call is over and, as far as I could tell, there is no way to get it back. So don't count on the program officer being able to see that you called. Leave a message if you want them to know that you called.

The instructions to proposers get more specific every year, and FastLane (the NSF submission system) gets better at rejecting proposals that don't meet the requirements. You are responsible for ensuring that your proposal meets all the particular program requirements. Follow the directions! (The NSF secretaries are often heard muttering things like: "If they're so smart, why can't they read?")

The number of proposals submitted to NSF has increased dramatically over the last decade. As a result, fewer proposals are funded. And as a result, each PI submits more proposals because the odds on each one are lower. **DO NOT** submit essentially the same proposal to several programs. The proposal will probably go to at least one duplicate reviewer, who will get angry that you are burdening the system, will recommend that both proposals be rejected, and will put a black mark next to your name. **DO NOT** submit a proposal that is rushed and not the best that you can do. Not only are you burdening the system by making everyone go through the work of declining your proposal, you are also damaging your reputation with

your peers. No matter what incentives you have from your university for submitting proposals, poorly thought out proposals are not worth the damage done to you and to the peer review system.

### **III. NSF Merit Review Criteria**

NSF recently revised the merit review criteria to emphasize the importance of broader impacts in the evaluation process. The following excerpt is from the instructions to NSF reviewers:

When evaluating NSF proposals, reviewers should consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits would accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers are asked to evaluate all proposals against two criteria:

- Intellectual Merit: The intellectual Merit criterion encompasses the potential to advance knowledge; and
- Broader Impacts: The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to
  - a. advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
  - b. benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or institution to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home institution or through collaborations) to carry out the proposed activities?

As you write your proposal, you should keep the review criteria in mind. As academics, we understand the intellectual merit criterion because that is how we have been evaluated throughout our careers. However, many academics struggle with the broader impacts criterion. You need to convince the reviewers that your question is not just intellectually challenging, but also that the resulting knowledge will benefit society and that you have a feasible plan to get the knowledge out of the university and get it used in the world.

### **IV. Putting together your proposal**

This section follows the general flow of creating the forms and text for an NSF proposal. Once you have a rough draft of your proposal, ask someone who is senior to you to read your

proposal as if he or she were an NSF reviewer. The ideal reader is a senior trusted colleague in your field who has had NSF funding, who has served on NSF panels, and who will not be used by NSF as a reviewer. (See Section 2.5.e on conflicts of interest.)

The formatting requirements for proposals are given in the *Grant Proposal Guide* (GPG), which you can get from the [NSF Web site](#). (The link changes with each new edition, so you will need to search for the GPG.) Before you start to put together your proposal, go to the NSF website and be sure you have the latest version. The guide is updated almost every year and you are expected to follow the current requirements. Your proposal may be returned without review if you don't do this.

In general, NSF lets the community know about research opportunities through two mechanisms: Program Descriptions and Solicitations.

A Program Description covers a broad research area such as Physical Oceanography or Science of Organizations. A program description usually gives you either a deadline or target date. Deadlines are hard dates, and you must get your proposal in by midnight (your local time) on the given date or your proposal will not be considered in the current round of funding. Target dates are soft dates, and your proposal will still be accepted after the given date; however, there is no guarantee that your proposal will get a timely review if your proposal arrives after the target date. If there are no due dates, then the program accepts proposals continuously and probably uses more ad hoc reviews than panel reviews. (Section V explains the difference between these types of reviews.)

A Solicitation is more specific than a Program Description. Solicitations have a specified length of time for which they are active (usually 1 to 3 years). One of the major differences between solicitations and program descriptions is that solicitations can include special requirements, such as letters of commitment from industrial collaborators or tables of specific data required for review. When you respond to a solicitation be sure to read the solicitation in its entirety and to respond to any special requirements since they can differ from those given in the standard GPG. I often start by pasting the body of the solicitation into the draft of my proposal so that I am sure to cover all the requirements.

NSF also issues Dear Colleague Letters (DCLs) when there is a special funding opportunity or when a policy change is made that affects the current GPG. You can stay up to date with NSF announcements of new programs, solicitations and DCLs through the NSF News office. To receive email updates, go to <http://www.nsf.gov/news/> and select Get News Updates by Email. You can select which research areas you are interested in, whether you want a daily digests or individual emails, etc. I get a daily digest, and I over- rather than under-select options. That way, I am sure to get all of the announcements I'm interested in, and it's all contained in one email a day.

## **1. Project Summary**

The summary is a one page overview of the proposal. It is not an abstract. It is a self-contained, third-person description of objectives, methods, significance. If you are funded,

this goes into NSF's Summary of Awards publication as well as being published on the [research.gov](http://research.gov) website. It will be read by your colleagues, the general public, and Congress. Because PIs were not explicitly addressing Intellectual Merit and Broader Impacts as instructed, NSF has changed the summary page to a form with separate sections for the overview, the statement of Intellectual Merit and the statement of Broader Impact.

Note: the Project Summary form accepts ASCII text only. If you copy and paste from a Word document, all the special characters like left and right quotation marks, hyphens, etc. will show up as question marks in the final version. Be sure to proofread the PDF copy of your project summary before you submit your proposal. Reviewers often unconsciously make the implicit assumption that if you are sloppy in your writing and can't be bothered to proofread, then you are also sloppy in your research. There is a provision to upload a PDF if your project summary requires special formatting for equations or other technical content; however, the PDF must follow the project summary requirements with separate headings for the overview, statement of Intellectual Merit and the statement of Broader Impact.

## **2. Project Description**

The project description has a 15 page limit. Proposals over this limit are returned without review. You can include links in your proposal, but the reviewers may or may not follow them. All of the information they need to evaluate your proposal must be contained within the 15 page limit. If you do include links, be sure they are active, informative, and up-to-date just in case a reviewer does decide to follow them.

### **2.1 Objectives and Expected Significance**

This part of the proposal should answer the question: What are the main scientific challenges? Emphasize what the new ideas are. Briefly describe the project's major goals and their impact on the state of the art. Give the reviewer the context for the proposal.

Clearly state the question you will address:

- Why is it important? What makes something important varies with the field. For some fields, the intellectual challenge should be emphasized, for others the practical applications should be emphasized.
- Why is it an interesting/difficult/challenging question? It must be neither trivial nor impossible.

### **2.2 Background and Technical Need**

- What long-term technical goals will this work serve?
- What are the main barriers to progress? What has led to success so far and what limitations remain? What is the missing knowledge?
- What aspects of the current state-of-the-art lead to this proposal? Why are these the right issues to be addressing now?
- What lessons from past and current research motivate your work? What value will

- your research provide? What is it that your results will make possible?
- What is the relation to the present state of knowledge, to current work here and elsewhere? Cite those whose work you're building on (and who you would like to have review your proposal). Don't insult anyone. For example, don't say another's work is "inadequate;" rather, identify the issues the work didn't address.

Surprisingly, this section can kill a proposal. You need to be able to put your work in context. Often, a proposal will appear naive because the relevant literature is not cited. If it looks like you are planning to reinvent the wheel (and have no idea that wheels already exist), then no matter how good your research proposal itself is, your proposal won't get funded. If you trash everyone else in your research field, saying their work is no good, you also will not get funded. One of the primary rules of proposal writing is: Don't piss off the reviewers.

You can build your credentials in this section by summarizing other people's work clearly and concisely and by stating how your work uses their ideas and how it differs from theirs.

### **2.3 Research Description**

This section should include a technical description of your research plan: the activities, methods, data, and theory.

This should be equivalent to a PhD thesis proposal for the big leagues. Write to convince the best person in your field that your idea deserves funding. Simultaneously, you must convince someone who is very smart but has no background in your sub-area. The goal of your proposal is to persuade the reviewers that your ideas are so important that they will take money out of the taxpayers' pockets and hand it to you.

This is the part that counts. WHAT will you do? Why is your strategy an appropriate one to pursue? What is the key idea that makes it possible for to answer this question? HOW will you achieve your goals? Concisely and coherently, this section should complete the arguments developed earlier and present your initial pass on how to solve the problems posed. Avoid repetitions and digressions.

In general, NSF is more interested in ideas than in deliverables. The question is: What will we know when you're done that we don't know now? The question is not: What will we have that we don't have now? That is, rather than saying that you will develop a system that will do X, Y and Z, instead say why it is important to be able to do X, Y and Z; why X, Y and Z can't be done now; what knowledge is needed to make X, Y, and Z possible, your plan that will make it possible to do X, Y and Z; and, by the way, you will demonstrate X, Y and Z in a system.

Right now, NSF is more open to application-oriented research. They need to show Congress that the money spent on research benefits the US economy. Some years ago, the word "applied" was a bad word at NSF. Now it's a good word. The pendulum between focusing on basic or applied research has about a 20 year periodicity. You always need to check to find

out where it is at the moment. Check with the PD and knowledgeable colleagues.

#### **2.4 Broader Impacts of the Proposed Work**

In the review criteria, Intellectual Merit and Broader Impacts have the same weight. From the GPG (emphasis mine):

*The Project Description must contain, as a separate section within the narrative, a section labeled "Broader Impacts of the Proposed Work". Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to the project. NSF values the advancement of scientific knowledge and activities that contribute to the achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.*

Remember that all of the proposals going to a review panel are in the same area of research, so you need to distinguish your proposal by what YOU are going to do to help NSF get the knowledge out of the academy and into the world. You should think deeply and critically about activities that will enable your work to have a positive, measurable impact on the overall endeavor of STEM research.

#### **2.5 Plan of Work**

Present a plan for how you will go about addressing/attacking/solving the questions you have raised. Discuss expected results and your plan for evaluating the results. How will you measure progress?

Include a discussion of milestones and expected dates of completion. (Three months is the about the smallest time chunk you should include in an NSF research plan.) You are not committed to following this plan - but you must present a FEASIBLE plan to convince the reviewers that you know how to go about getting research results.

For new PIs, this is often the hardest section to write. You don't have to write the plan that you will follow no matter what. Think of it instead as presenting a possible path from where you are now to where you want to be at the end of the research. Give as much detail as you can. (You will always have at least one reviewer who is a stickler for details.)

### **3. Results from Prior NSF Support**

If any of the PIs have received NSF support in the past 5 years, you must include a summary of the results of previous work. The pages in this section count toward the total 15 pages.



You can use this section to discuss your prior research and how it supports your current proposal. Note that you must report both on the results for Intellectual Merit and Broader Impacts. One of the purposes of this section is to help the reviewers evaluate your track record, so be sure to make a strong case for your results in both categories.

- Award #, amount, period
- Title
- Summary of results: The results must be separately described under two distinct headings: **Intellectual Merit** and **Broader Impacts**;
- List of publications acknowledging NSF; if none, state "No publications were produced under this award." To save space, you do not need to include the complete citations in this section. You can cite them as references, included in the References section.
- Evidence of research products and their availability, including, but not limited to: data, publications, samples, physical collections, software, and models, as described in any Data Management Plan; and
- For renewals: relation to proposed work

#### **4. References**

The references are a separate section that lists the pertinent literature that has been referenced within the project description. Remember to proofread the reference list. Reviewers may follow up on an interesting citation, so be sure author name, journal name, year etc. are correct.

Program directors often look in the bibliography for potential reviewers, and reviewers often look in the bibliography to see if their work is cited. If your bibliography has a lot of peripheral references, your proposal may be sent to reviewers whose work is not directly related to yours and who may not understand your proposal. On the other hand, if you do not cite the relevant literature, your proposal may be sent to reviewers who are not cited and who will criticize you for not knowing the literature. The references do not count in the 15 page proposal limit.

#### **5. Biographical Sketches**

Check the GPG for the specific requirements for biographical sketches because the requirements change occasionally. The goal of the biosketch is to provide reviewers with your credentials that will help them evaluate whether you have the background, knowledge and skills to perform the proposed research. The biosketch also helps identify your conflicts of interest.

Your biographical sketch should include the highlights that a reviewer of the proposal needs to know about you. Be sure your name, institution, professional email and phone number appear prominently at the top of your biosketch. Be sure that you do not include any personally identifying information including your cell phone number, home address, private

email address, etc.

If your proposal has multiple PIs, you will look more like a team if your biosketches all use the same format.

The current requirements are:

a) Your professional preparation: undergraduate, graduate and postdoctoral. Include the institution, major, degree and year.

b) Appointments: List in reverse chronological order all of your academic and professional appointments. Include your current appointment

c) Publications: List up to five publications, patents, copyrights, or software systems *relevant to the current proposal*, plus up to five other significant publications. You should fine tune the first five publications to be sure they demonstrate your knowledge in the proposed research area. Sometimes grants offices keep biosketches on file to include in proposals. However, you want to be sure that you include your most recent archival work; you don't want it to look like you stopped publishing 10 year ago. Also, if you work in several areas or want to highlight a particular area of expertise, be sure to select your five works most relevant to the current proposal.

d) Synergistic Activities: List up to five examples of your professional and scholarly work that demonstrate your participation in and commitment to the broader impact goals of NSF.

e) Collaborators and other affiliations; Conflicts of Interest (COI): This section has three parts: a) collaborators and co-editors; b) your graduate and post graduate advisors and c) the current and former students who you advised as graduate or post graduate students. (See the GPG for the exact requirements.)

The information in this section serves many purposes. A reviewer may be interested in the number of PhD students you have advised and what kinds of careers they have gone on to; they may look at your collaborators to see whether you work with industry, with people from other fields, or with people at other universities.

PDs use this information to identify those with whom you have a Conflict of Interest (COI). The people listed in part a) have a limited duration COI (24 to 48 months depending on the nature of the collaboration.) The people listed in b) and c) have a life-time COI. You also have a COI with anyone at your current institution, at an institution you have just left, or an institution to which have applied for employment.

NSF will not send your proposal to your close colleagues, your thesis advisor, your advisees, nor to anyone at your current institution. You may list such people explicitly, if you wish.

## **6. Budget**

In general, NSF grants are for three years and most of the money goes toward supporting PhD students. A typical budget for a single PI grant is about \$100K/year, which will pay for a graduate student (tuition and stipend), about 10% of the professor's time to supervise the student, a little bit of travel, copying, and overhead. However, the grant size varies from division to division. Ask someone in your area what is typical.

Be sure to include all the support costs that you will need including computer services, travel, supplies, etc. NSF may cut your budget, but they'll never give you more than you ask for, so be sure to ask for everything you need.

Describe, justify, and estimate cost of equipment items \$5000 or more. (Double check the GPG for the current dollar limit.) If your equipment needs change between the time you submit the proposal and the time it is granted, you can still buy what you need -- But be sure to talk to the university grants office BEFORE you buy the new equipment. There are special rules about equipment money because it is usually exempt from overhead charges. Also, NSF will only provide equipment money for research computers. Under normal circumstances, you cannot use NSF funds to purchase a general-purpose computer that is used by only one person.

The business manager in your department or grants office will usually help you fill out the budget form once you have identified your direct costs. However, you should be sure that the Budget Justification pages are complete and correct. Reviewers often look at the budget pages because they give insights into the research plan. Who is being paid to do the work? What priorities are reflected in the budget? Are the resources requested sufficient to carry out the plan? Does the budget look padded or lean? For example, if you ask for thousands of dollars in international travel which isn't justified within your proposal, this will raise red flags with the reviewers.

Note that NSF does not allow voluntary cost sharing. Unless a solicitation gives special instructions for overhead rates, you must use the overhead rate negotiated by your university; you cannot reduce the bottom line on your budget by changing the overhead rate.

## **7. Current and Pending Support**

List all current and pending support on the given forms. Your institution's grants office can probably help with these.

If you have submitted the same proposal to more than one agency, be sure that you declare it on the cover page and in the current and pending support section. If you don't and the same reviewer is picked by both agencies, you won't get funded and your reputation will be damaged. Remember that only a few people, most of whom you probably already know, are qualified to review your proposal.

## **8. Facilities and Special Considerations**

This section should focus on the facilities available to you that you need to do your research. If you will rely on any specialized equipment, describe it. The question in the reviewer's mind is: Do you have the necessary resources to carry out the research? In addition, if you are asking for equipment in your proposal, you will want to make clear what equipment you don't have. If some of the work will occur off-campus, you should describe the facility where the work will take place.

## **9. Postdoctoral Researcher Mentoring Plan**

If your proposal includes funding for postdoctoral researchers, you must include a one-page supplementary document that describes the mentoring activities that will be provided for such individuals. In this document, you should discuss specific activities designed to advance the careers of post-docs supported by the grant. Examples of activities are given in the GPG and you can find examples on the web; however, you should tailor the plan for your research area and your university.

## **10. Data Management Plan**

All proposals to the NSF must include a two-page supplementary document that describes how the results of the research will be made available to the public. The plan should cover:

1. the types of data, samples, physical collections, software, curriculum materials, and other materials to be produced in the course of the project;
2. the standards to be used for data and metadata format and content (where existing standards are absent or deemed inadequate, this should be documented along with any proposed solutions or remedies);
3. policies for access and sharing including provisions for appropriate protection of privacy, confidentiality, security, intellectual property, or other rights or requirements;
4. policies and provisions for re-use, re-distribution, and the production of derivatives; and
5. plans for archiving data, samples, and other research products, and for preservation of access to them.

Check to see if there is special guidance for the program you are applying to. Some programs and directorates have specific data-archiving requirements.

Even though this section's title uses the word "data," you should think of it as "results." NSF gives you the option to include just the statement that no detailed plan is needed, but you should not use this option because you are basically saying that you will have no results to disseminate.

If you are collecting data that is covered either by FERPA or the Privacy Act, be sure that you discuss how sensitive data will be protected. Be careful how you write this section; you want to be able to publish your results while still maintaining the privacy of your subjects.

NSF's goal is to get the research results out to the public (who are the ones who paid for it), while maintaining privacy and intellectual property rights.

Again, you can find many sample data management plans on the web. Be sure that your plan is relevant to your research and your university.

## **V. What happens to your proposal after it is submitted to NSF?**

All proposals arrive at NSF electronically - mostly through [www.fastlane.nsf.gov](http://www.fastlane.nsf.gov) and occasionally through [www.grants.gov](http://www.grants.gov). The proposals are routed based on the program announcement number or the NSF division given by the PI. (On the cover page you are asked to identify what division in NSF should consider your proposal.) Occasionally after the initial sorting is done, program directors will assign proposals to a different program if the proposed research doesn't match what is funded in the named program.

Once the proposal has been assigned to a program director, it is ready for review. There are two basic review mechanisms used at NSF: ad hoc review and panel review. Both are single blind peer review mechanisms: that is, the reviewers (who are the PI's peers) know who the PI is, but the PI does not know who the reviewers are.

Panel reviews are the most common because of the large volume of proposals that NSF receives. Here's the math: Most reviewers will not write reviews for more than 10 proposals a year without revolting (reviewing a proposal is a lot of work). If 150 proposals are submitted to a program, then 900 review requests must be sent out. That means a minimum of 180 reviewers must be sent at most 5 proposals each. Three reviews per person per year is more realistic - so that means the program director must have access to 300 of the proposal writers' peers in order to get the peer review system to work. And that's just for one program. All the other program directors are working with the same numbers -- and the expertise of many reviewers overlaps several programs.

**Panel review:** For a panel review, the program director selects 10 to 15 experts in a field and asks them review a set of related proposals. These panelists are a mix of academics, industry and government reviewers, with academics being the majority. Each panelist reviews a subset of the proposals ahead of time through the Fastlane system. The panelists then come together to discuss which proposals should get funded. Most reviewers find it easier to rank a set of proposals than to write a detailed review of each proposal. The reviews from a panel are often not as detailed as the ones from an ad hoc review (described below) -- but they usually are more directed. If one reviewer completely misses the point of a proposal (which they sometimes do), this will come out during the panel discussion so you get fewer out-in-left-field reviews from panels than from ad hoc review. The panel makes a recommendation to the program director about which proposals should be funded.

**Ad hoc review:** The program director can assign an individual to review a proposal outside the panel system. Ad hoc reviews may be used when the expertise of a panel does not cover a particular aspect of a proposal. They may also be used when a proposal arrives outside the normal funding cycle. The proposal is assigned to ad hoc reviewers through the Fastlane

system. The reviewer is given about two weeks to a month to review the proposal. Again, the review happens within the Fastlane system.

Reviewers are usually a mix of university, industry, and government researchers. Almost always, the majority are academics.

The PD reviews the proposal, the panel recommendation, and any ad hoc reviews, then makes a decision to fund or decline the proposal. The PDs must exercise judgment. For example, a reviewer might appear to be a perfect match for a proposal -- but when the review comes in, it may be obvious that the PI's work conflicts with the reviewers work, and the reviewer is biased.

Often the decision to fund involves deciding whether to fund the proposal at the full or reduced amount. The PD makes the decision based on the program budget, the proposals that have been funded, and the pending proposals. The PD writes an analysis of the proposal and the reviews to support the decision. The proposal goes to the division director who must concur with the decision for it to be official. You are notified by email once the decision is final. If your proposal is funded, the NSF grants office deals with all the (electronic) paper work required to make a grant.

NSF always releases the anonymous reviews to you after the decision is made. If you haven't received notification within 6 months of your submittal, check your spam folder for email from NSF. (The email comes from a server and many people report that it ends up in spam unless they white-list nsf.gov.) You can also login to Fastlane to check the status. Only call the PD as a last resort.

Note: A grant from NSF goes to the institution, not to the PI. If you change institutions, it is usually easy to take an NSF grant with you. However, you must negotiate with your current and future institution. NSF will not intervene in these negotiations.

Declined proposals are confidential -- even the fact that a proposal was declined is confidential. For grants, the titles, abstracts, PIs, funding amounts, .. are public information, but the proposal itself is confidential.

## **VI. FastLane**

Almost all NSF information is available over the web. The main NSF web page <http://www.nsf.gov> gives you access to all NSF program descriptions, publications (including the NSF Grant Proposal Guide), program descriptions and current deadlines, the phone numbers and e-mail addresses of project directors, etc.

The FastLane system <http://www.fastlane.nsf.gov> is an interactive real-time system used to conduct NSF business over the Internet. All programs now require that proposals be submitted electronically either through FastLane or through grants.gov. The grants office at your institution can set up an account for you so that you can submit proposals and check their status through FastLane. If you are asked to write a review or be on a panel, the program

officer will give you an id and password to give you access to the proposals.

Aside on Fastlane: The first time I was a PD at NSF in the mid 1980s, Fastlane was just coming into existence through the efforts of Erich Bloch, then the Director of NSF and a former IBM researcher and executive. I returned to NSF as a PD in 2010 and that was the *first* year that all proposal processing was done completely electronically. In order to update the software methods and make NSF funding more transparent to the public, the current plan is to migrate the functions of Fastlane to research.gov and to grants.gov. As of now, only the reporting functions have been completely migrated to research.gov.

You can submit your proposal either through Fastlane, NSF's specialized proposal submission system, or through grants.gov, the submission system for all proposals to the US government. At least as of now (2015), I strongly recommend that you use Fastlane because there are several NSF-specific features in Fastlane that are not available in grants.gov. Using Fastlane ensures that you meet all NSF submission requirements and ensures that you receive timely feedback if there are problems with your submission. In the long run, Fastlane will almost certainly be subsumed by grants.gov, but the research community will receive many warnings and updates before this occurs. If your institution's grants office requires you to use grants.gov, don't worry that your proposal will be penalized. It just requires more work on the part of the NSF support staff both to get the proposal from grants.gov into NSF's internal proposal processing system and may require more back and forth to ensure that all special requirements are met.

Start early if you haven't used Fastlane before. There are many sections and forms to fill out. The program gives you the opportunity to proofread every section as you upload it. Always click "Proofread PDF" button. READ the pdf and be sure it is OK before you hit the "Accept" button. Do not treat the "Accept" button like a "Yeah, Sure, Whatever" button. Don't call the PD and ask to replace a corrupt file with the correct one. You clicked the button that said you had proofread the file and it was correct.

## **VII. Being a panelist or reviewer**

Remember that for every proposal you submit to NSF, at least five or six of your peers take the time to read it, write a review, and travel to DC to discuss it. Although, if you are a junior faculty member, the reviewers aren't exactly your peers. Panels tend to be weighted toward more senior members of the community, and these are the people who will be asked to write letters for your promotion and tenure case and they are also the people who are on program committees and editorial boards. Only submit your best work!

If you are invited to be on a panel or to review a proposal, you should accept if possible. Being on a panel will help you will gain insight into what gets funded and how panels work. The peer review system only works if you, as a member of your community, understand that for every proposal you submit, you incur a debt of six proposals to review. Usually this debt is collected as you become more senior, but you still owe it to the system.

## VIII. NSF Terms and Acronyms

Here are a few common NSF acronyms. Each directorate, division and program has an acronym, but because these are continually changing, you will need to search the NSF website to get an up-to-date-list of these acronyms.

AD	Assistant Director (despite the name, this is a dean-like position. The AD is one level below the Director of NSF)
COI	Conflict of interest
DCL	Dear Colleague Letter
DD	Division Director
fastlane.gov	NSF electronic system for proposal submission, review and management
GPG	Grant Proposal Guide
PD, PO, PM	Program Manager
PI	Principal Investigator
research.gov	The functions of fastlane are in the process of being transitioned to research.gov.
RWR	Return without review: If proposals do not following the requirements of the GPG or a particular solicitation, they are returned without review
STEM	Science, Technology, Engineering and Math: the purview of NSF